

Botany

the study of plants

General Biology
Mr. Cobb

Why study plants?

Food (soybeans, corn, rice, etc.)

Raw materials (cotton, lumber, hemp, etc.)

Beauty and Landscaping

Medicine

Ecology (gauge ecosystem health)

Oxygen

What is a plant?

- ❖ Cells are eukaryotic
- ❖ Chlorophyll (most of the time green)
- ❖ Made up of tissues and sometimes organs
- ❖ Cellulose in the cell wall
- ❖ Autotrophic
- ❖ Sexual reproduction
- ❖ Don't move around
- ❖ A few plants are heterotrophic

Plant Classification

❖ There are three main groups of plants:

1. Nonvascular (lack vascular tissue) - small

ex. mosses, liverworts

2. Vascular without seeds

ex. Ferns

3. Vascular with seeds

ex. Gymnosperms, Angiosperms

Plant Kingdom

Gymnosperms



Angiosperms



Pteridophyta
(ferns)



Spores

Seeds



Bryophytes

Mosses

Liverworts

Tracheophytes

(vascular plants)

NonVascular

Nonvascular Plants

- ❖ Mosses, Liverworts, and Hornworts
- ❖ Bryophytes is the moss phylum and most recognized.
- ❖ Lack vascular tissue to transport to move water and dissolved materials throughout the plant.
- ❖ Usually very small
- ❖ Produce spores, not seeds.



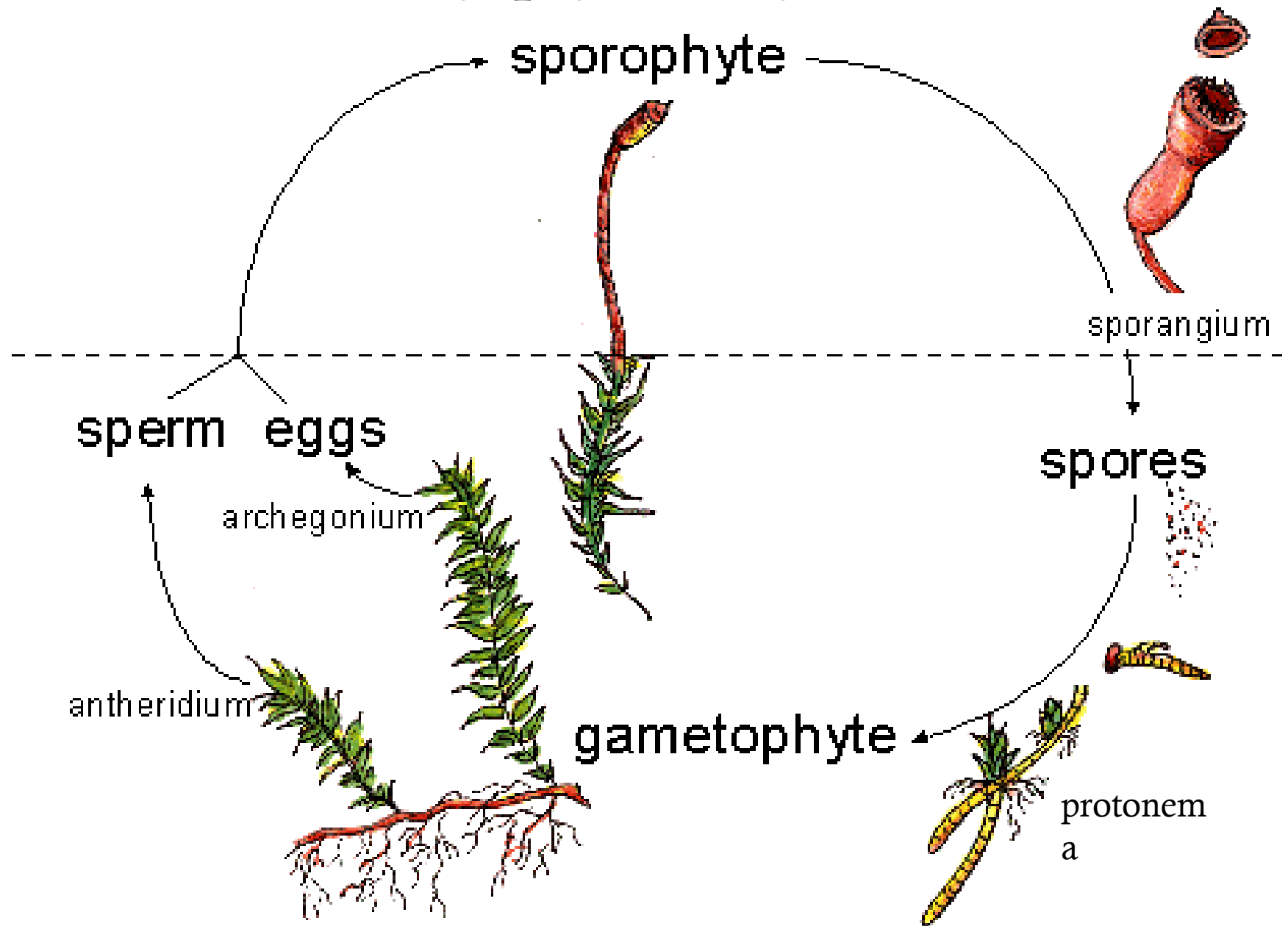
Nonvascular Plants

- ❖ Small
- ❖ No true leaves
- ❖ No true stems
- ❖ No true roots



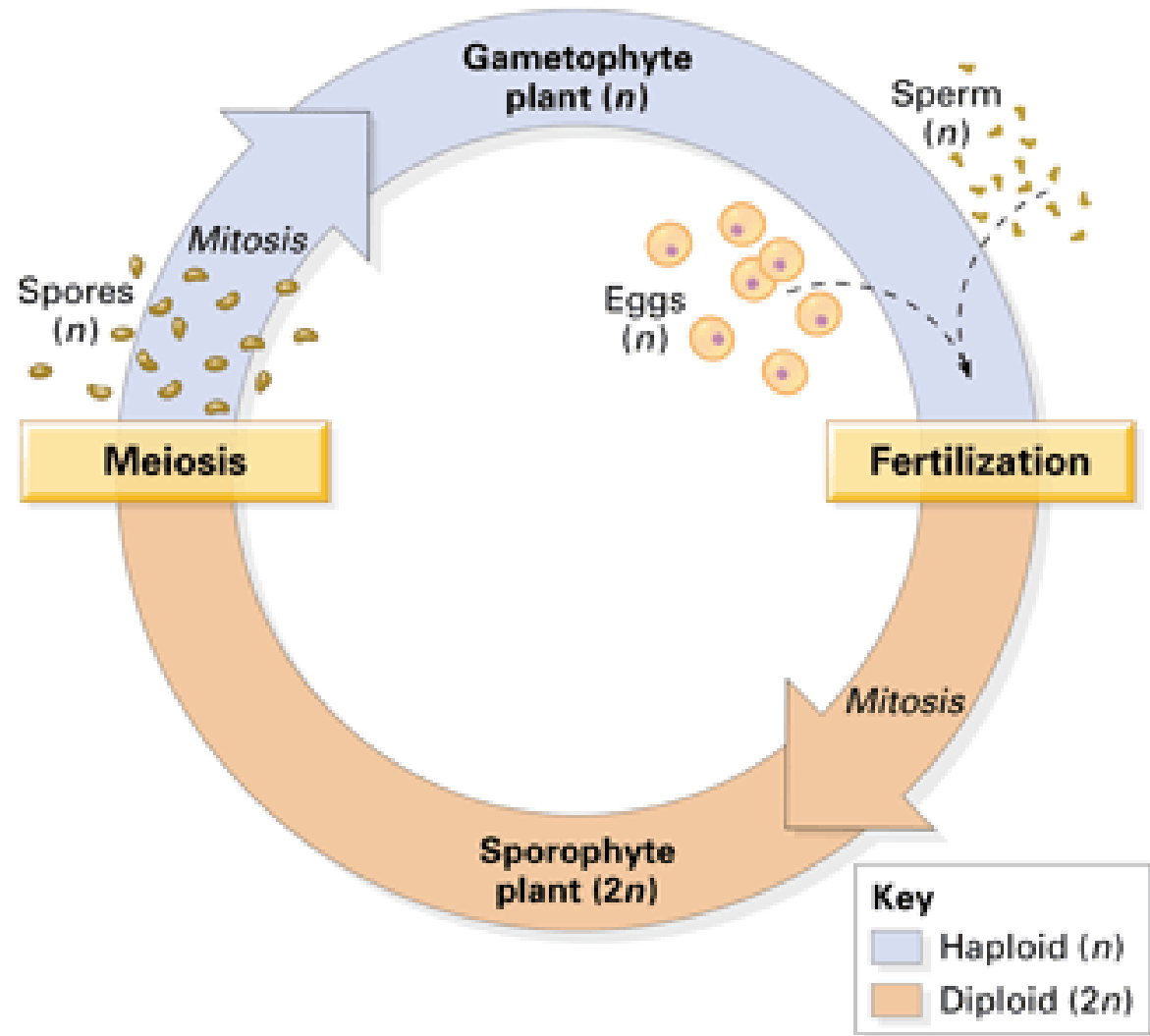
- ❖ Gametophyte – alteration of generations – this means they are haploid as an adult and diploid as a sporophyte.

Bryophyte life cycle



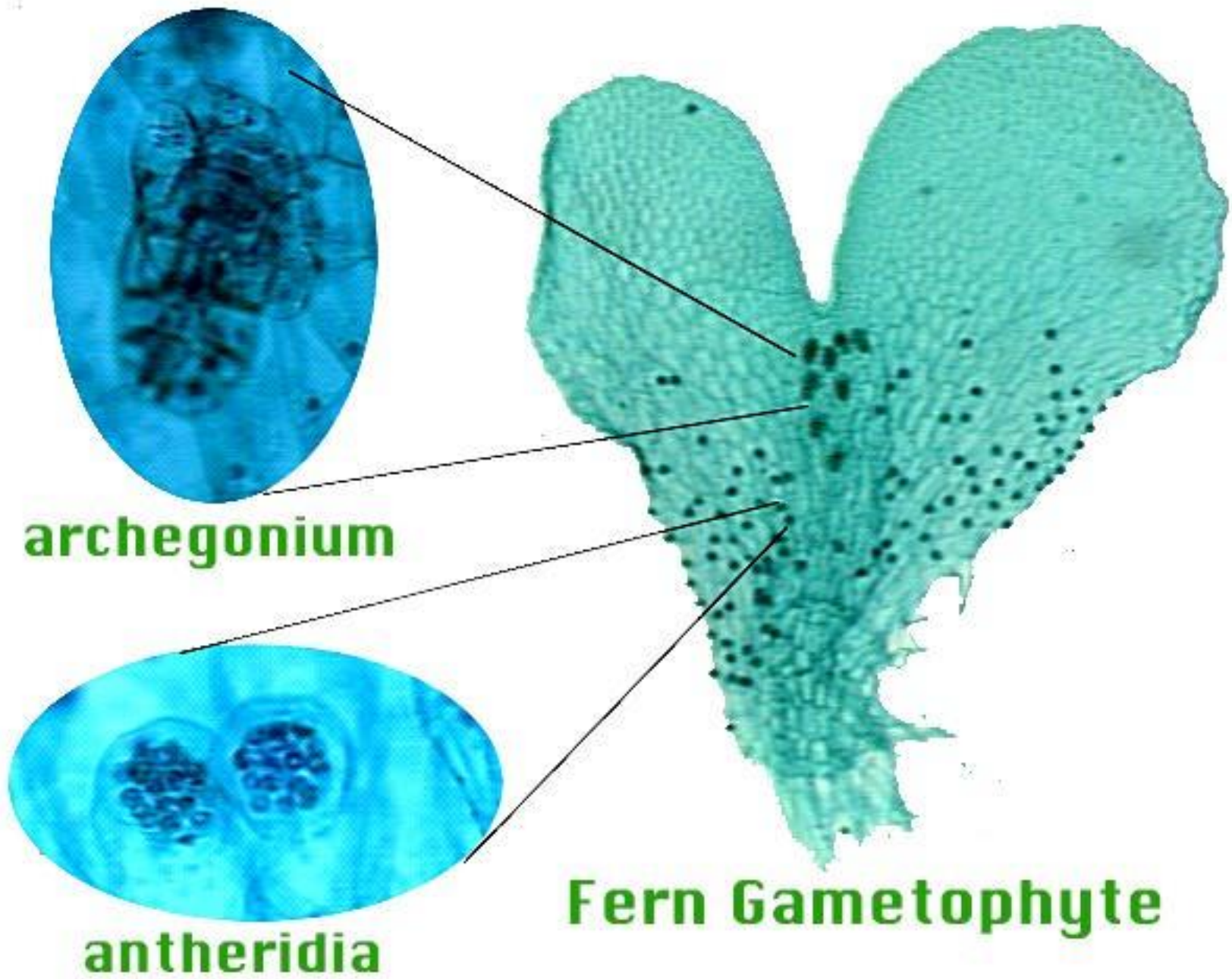
Plant Life Cycle

ALTERNATION OF GENERATIONS

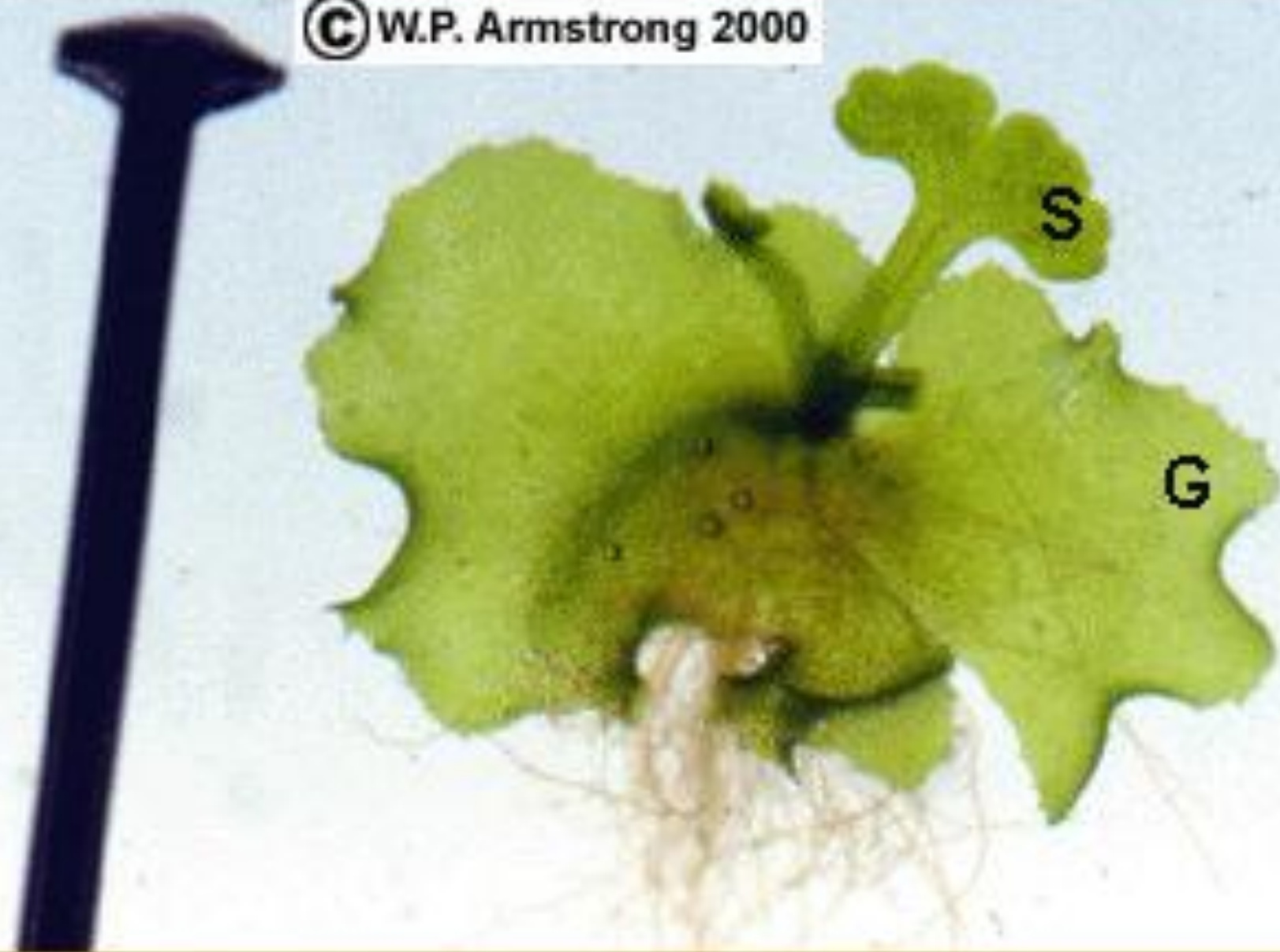


Vascular Plants without seeds

- ❖ Typical Ferns (Pteridophyta phylum)
- ❖ Leaves are called fronds.
- ❖ Collection of spores on the bottom of leaves called sori.
- ❖ Unique reproduction of a heart shaped gametophyte.



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sori

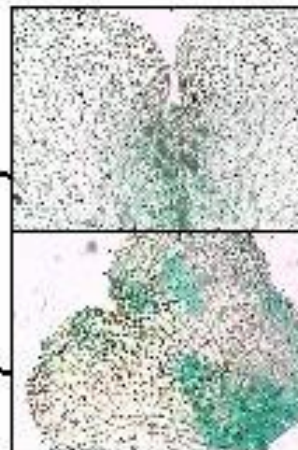


sporangia

$2N$
 N

Meiosis

spores



archegonia

antheridia

Fertilization

zygote

Sperm

eggs

Vascular Plants without seeds

- ❖ 3 other phyla include such plants as horsetails, club mosses, and whisk ferns.



Horsetail



Club Moss



Whisk Fern

Vascular plants with seeds

- ❖ Gymnosperms = naked seed
 - ❖ Phylum Coniferophyta: Cone bearing plants



- ❖ *Angiosperms*

- ❖ *Phylum Anthophyta: The flowering plants*



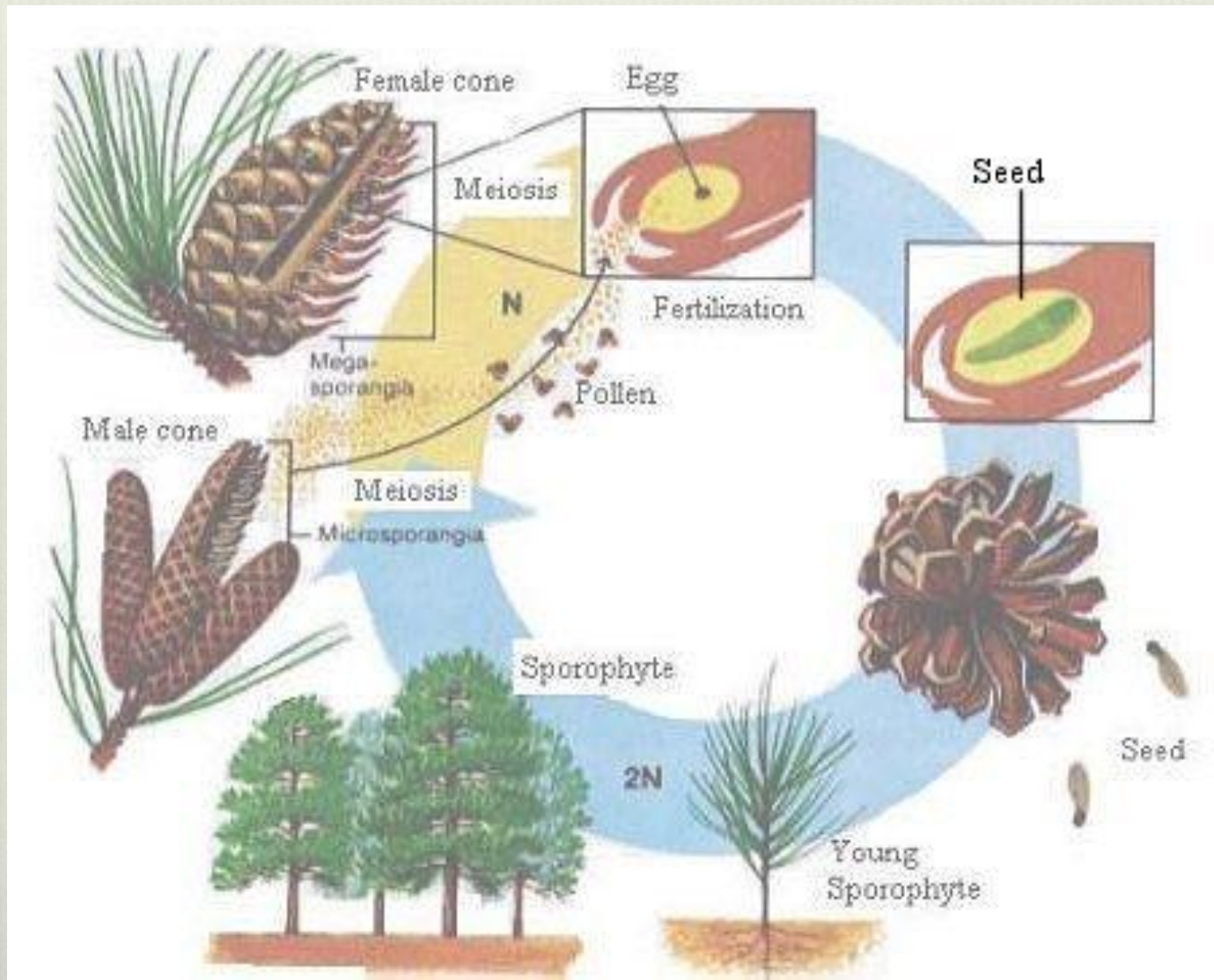
Coniferophyta

- ❖ Seeds in cones (pollen cones and seed cones)
- ❖ Evergreen
- ❖ No flower
- ❖ Notable members:
 - ❖ Pine
 - ❖ Yew
 - ❖ Cypress
 - ❖ Redwood



California Redwood Trees

Conifer life cycle



Phylum Anthophyta (Flowering Plants)

- ❖ Angiosperms
- ❖ Seeds enclosed in an ovary
- ❖ Flowers
- ❖ Dominant vegetation
- ❖ Mature ovary is the fruit



Flowering Plants

There are two classes:

These are divided by the number of cotyledons in the seed and the leaves of the embryonic plant.

1. Monocots
2. Dicots

Monocots

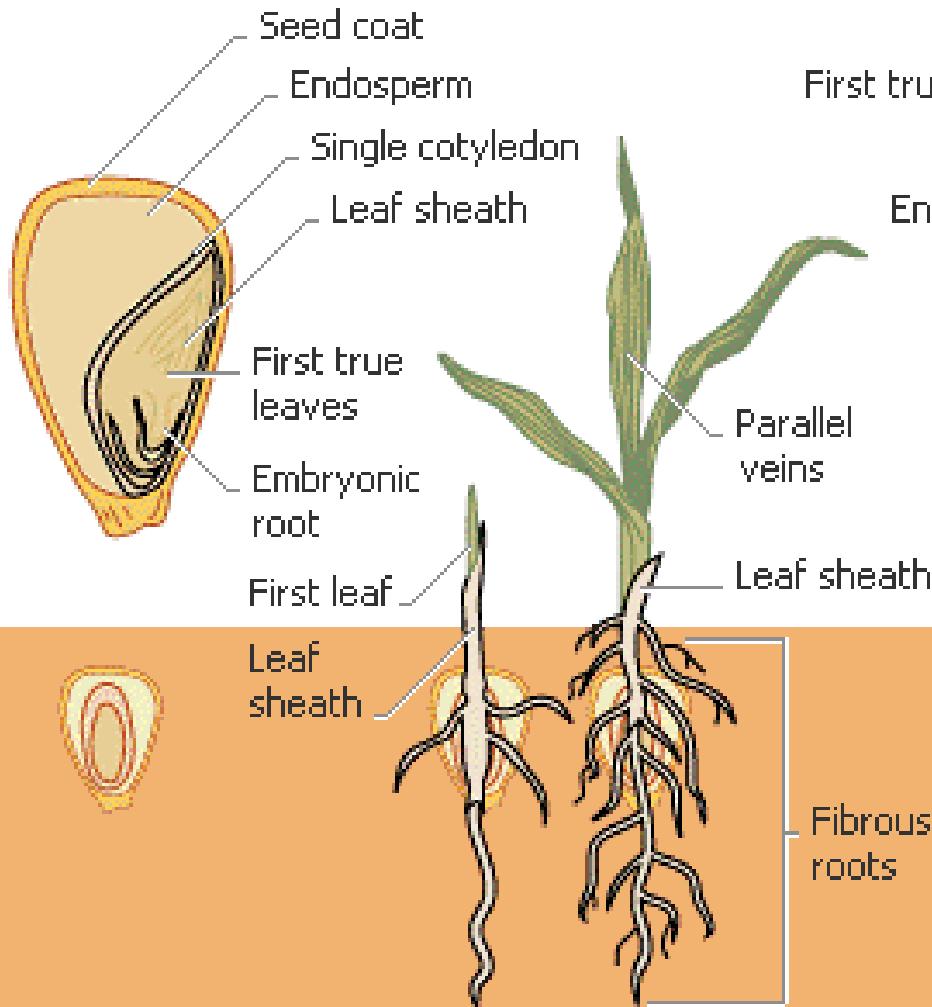
- ❖ only one cotyledon in the seed
- ❖ only one leaf in the embryonic plant
- ❖ Parallel leaf venation (like a blade of grass)
- ❖ Flower parts in 3 and 6
- ❖ Fibrous roots
- ❖ Check page 343

Dicots

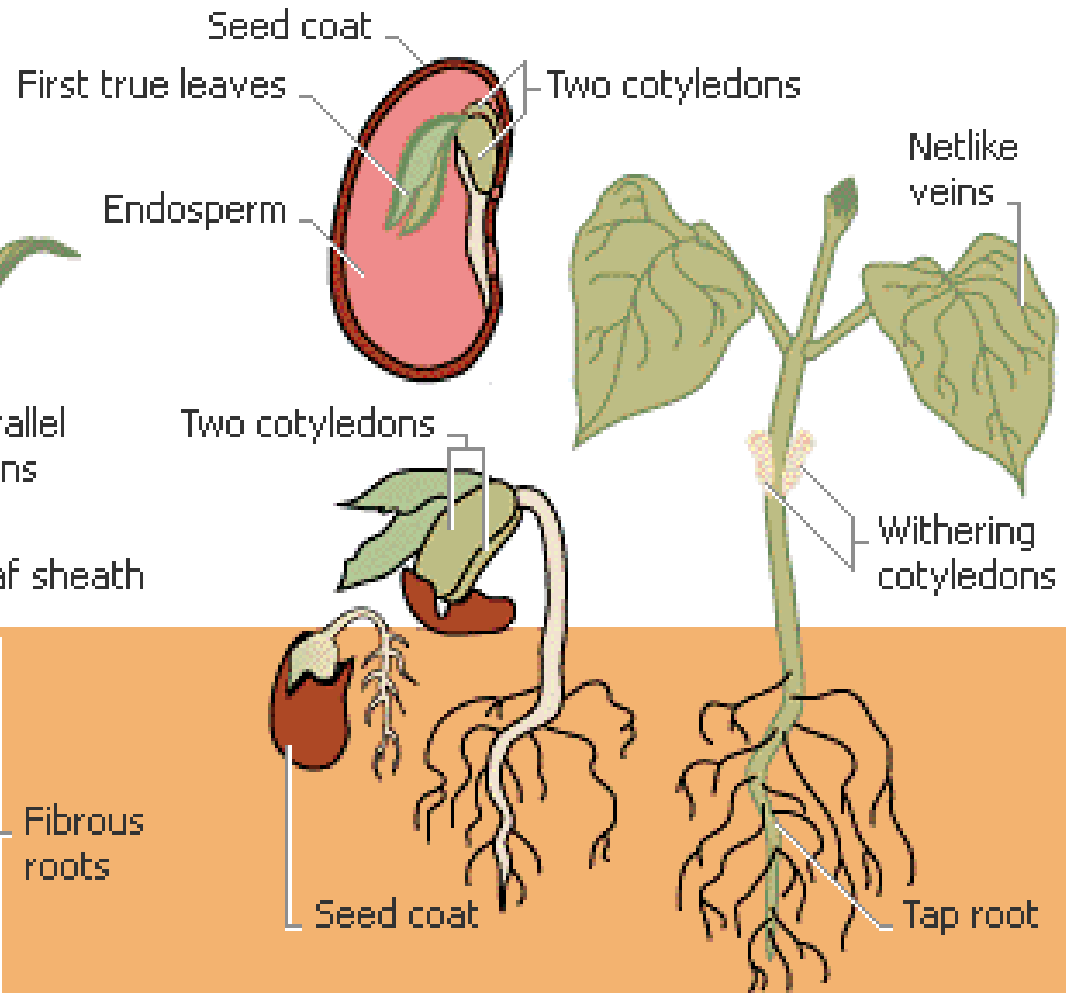
- ❖ 2 cotyledons in the seed
- ❖ 2 leaves in the embryonic plant
- ❖ Netted venation
- ❖ Usually a tap root
- ❖ Vascular bundles
- ❖ Leaves in 4s and 5s

Monocot vs. Dicot

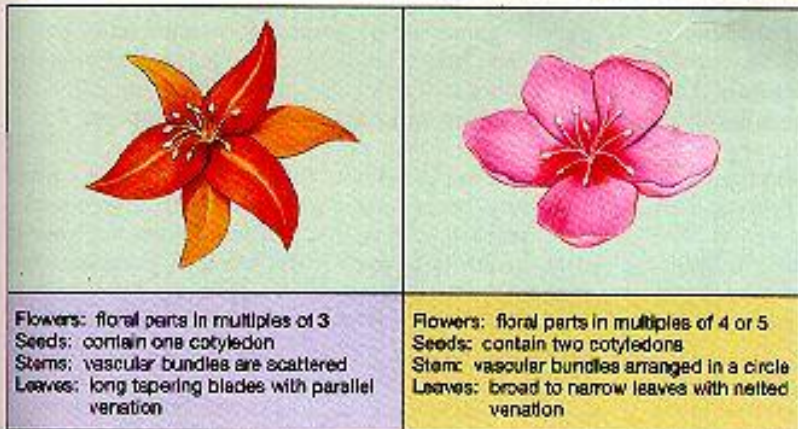
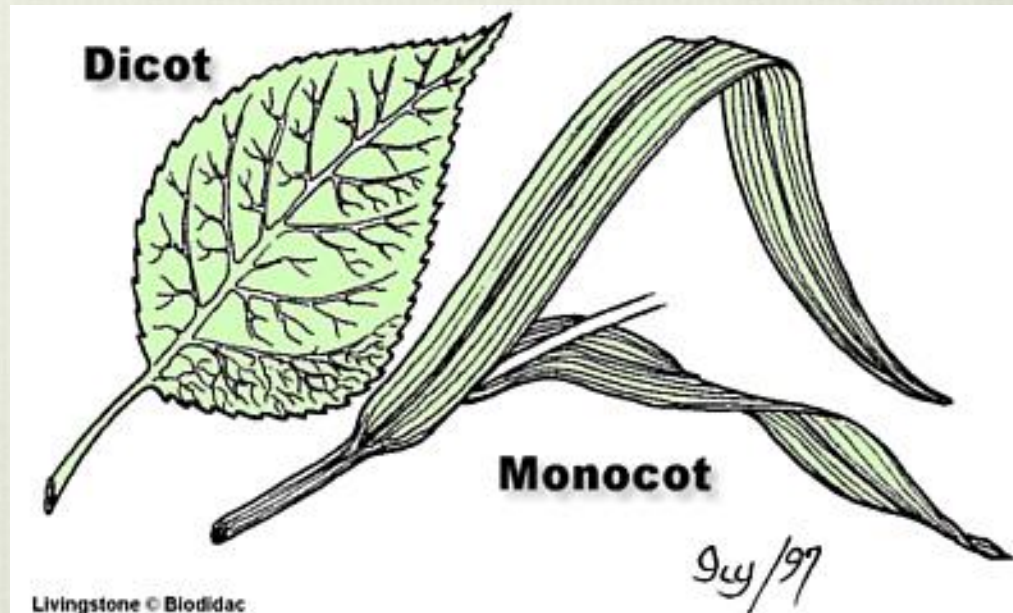
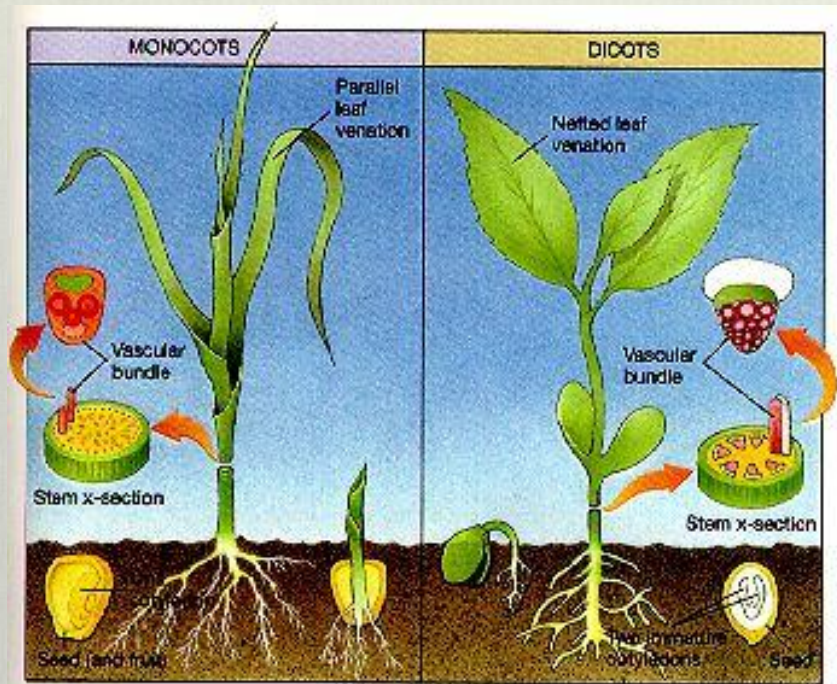
Monocotyledon (corn)



Dicotyledon (bean)



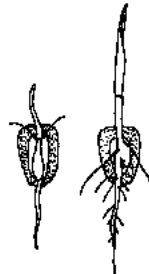
Monocot vs. Dicot



Monocots vs. Dicots

MONOCOTS

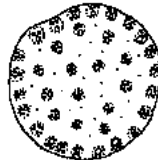
1 Cotyledon (seed leaf)
cotyledon



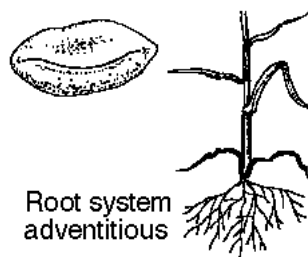
Parallel-veined leaves



Primary vascular bundles
scattered



Pollen monosulcate



Root system
adventitious

Floral parts in 3's

Fewer than 10% of
species are woody

DICOTS

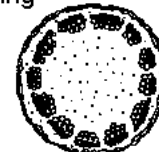
2 cotyledons



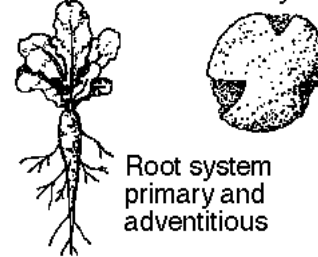
Net-veined leaves



Primary vascular bundles
in a ring



Pollen mostly tricolpate



Root system
primary and
adventitious

Floral parts in 4's or 5's

About 50% of species
are woody

Plant Anatomy

❖ Three basic tissue types:

1. Dermal Tissue

the outside covering of the plant or the skin.

2. Vascular Tissue

xylem – transports water up the stem

phloem- transport nutrients from photosynthesis down the plant.

3. Ground Tissue

4.) Meristematic tissues:

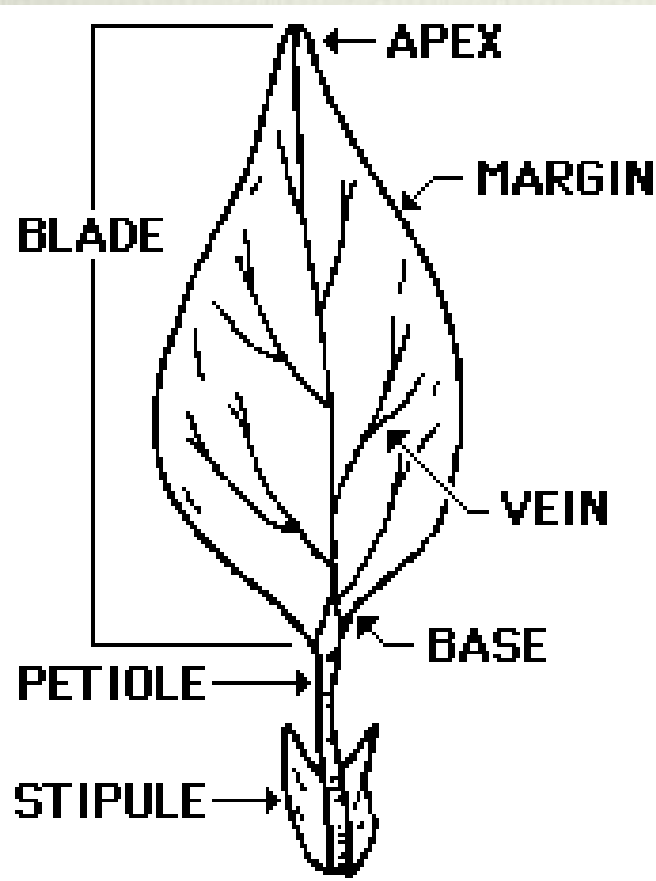
made of small, thin-walled cells
undifferentiated

capable of mitosis

Found in buds, tips of roots & stems,
& vascular bundles

Plant Structure

petiole: stem that attaches leaf



stipule: wing-like

to petiole

blade: flattened leaf

margin: edge

Leaf Venation

Parallel



Netted



Palmate



Pinnate

Leaf Shape



Simple Palmate



Compound Palmate

Leaf Shape



Simple Pinnate



Compound Pinnate

Leaf Edges

Leaf Margins



entire



dentate

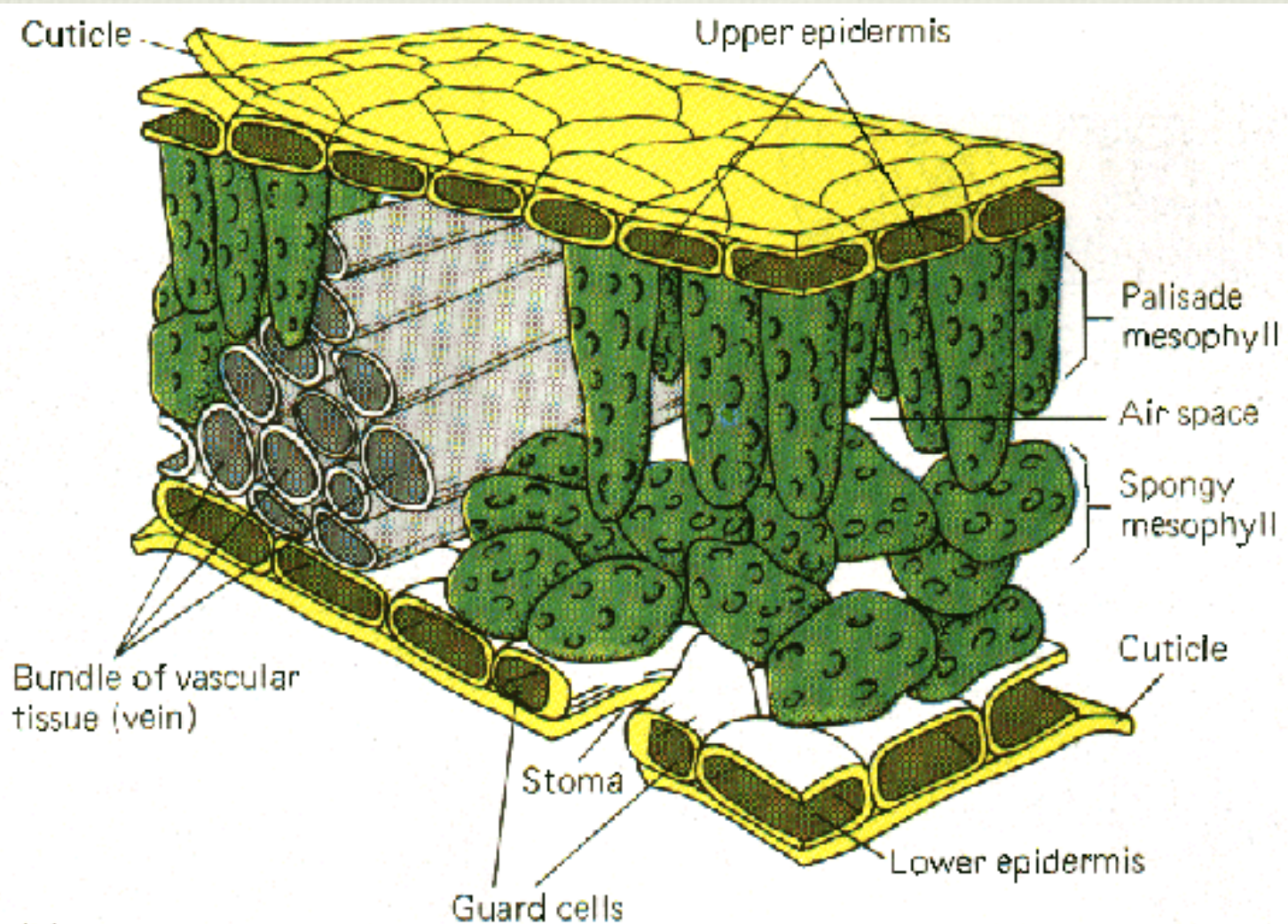


undulate



serate

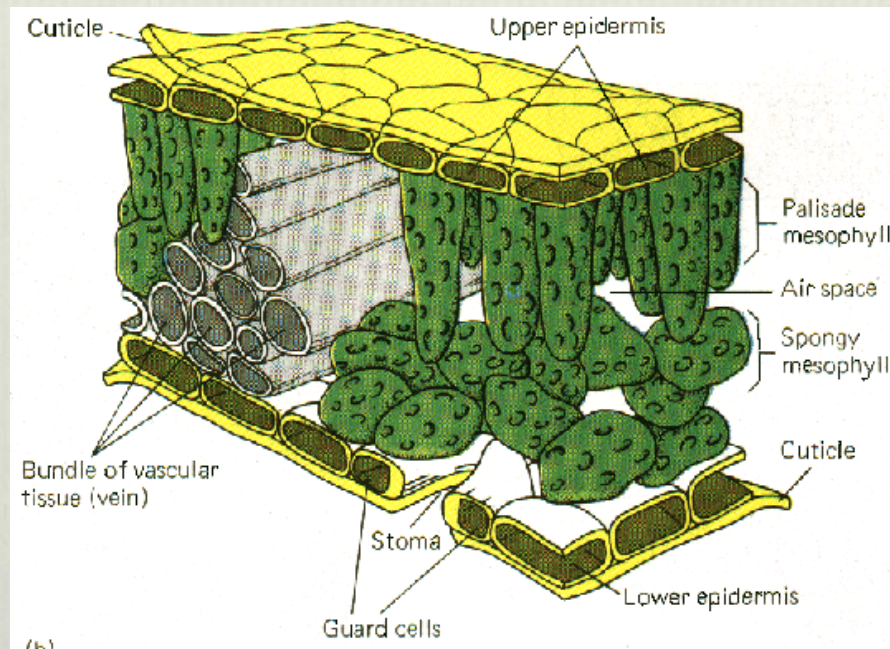
Leaf Cross Section



Plant Structure

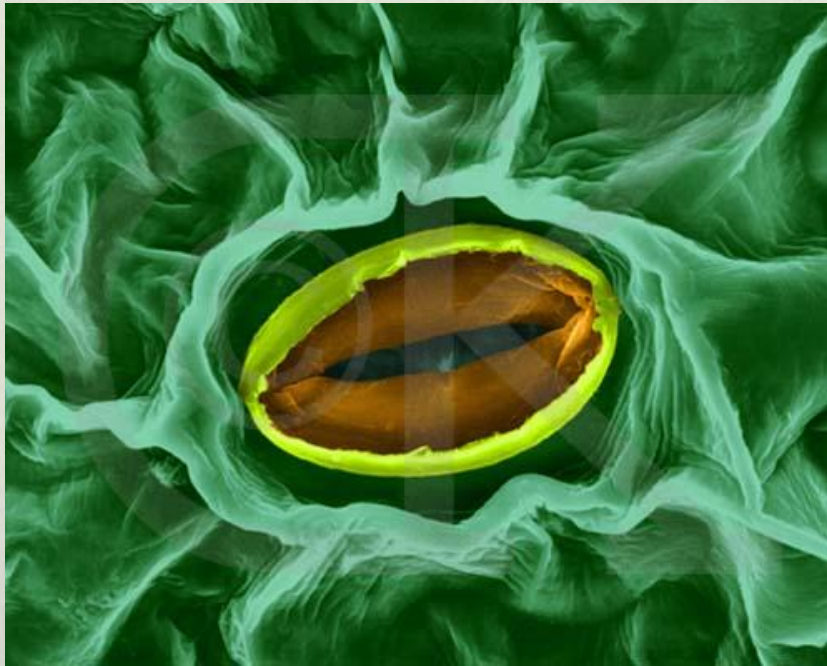
Stomata: openings on the underside of leaves;

regulate gas exchange, surrounded by guard cells



Stomata

Stomata: little openings on the underside of leaves; regulate gas exchange surrounded by guard cells



Fibrous and Tap roots

Root Functions

- * anchor
- * absorb H_2O
& minerals
- * transport
- * food storage

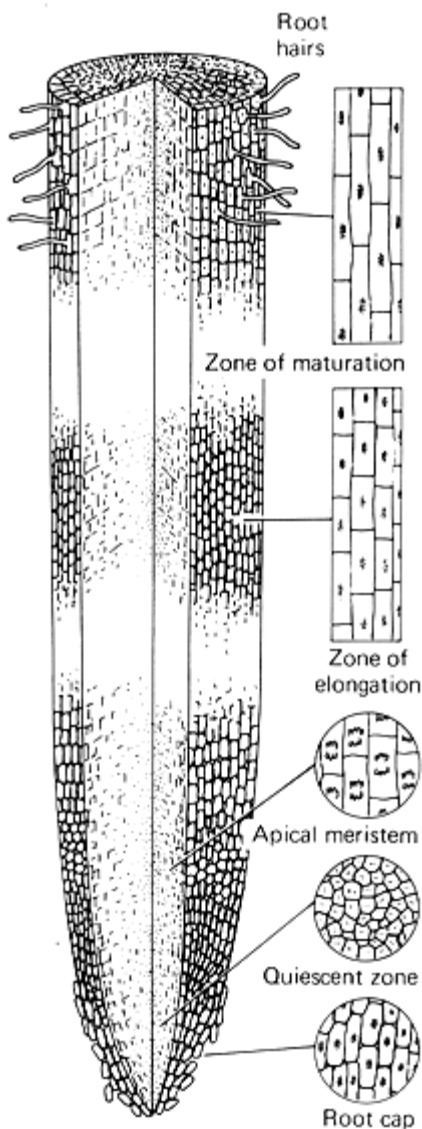
fibrous root



tap root



Root Structure



Root Structure – Primary Growth

maturation region: cell differentiation

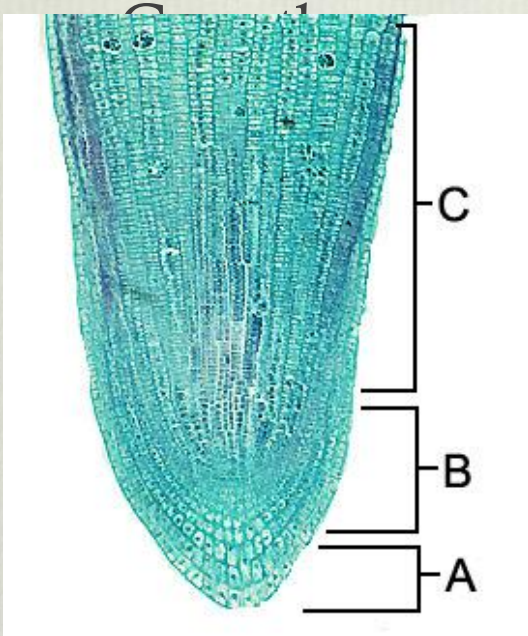
elongation region: growth & vacuole

meristematic region: cell division

root cap: root protection

Root Structure

Root Structure – Primary



maturation region: cell differentiation

elongation region: growth & vacuole

meristematic region: cell division

root cap: root protection

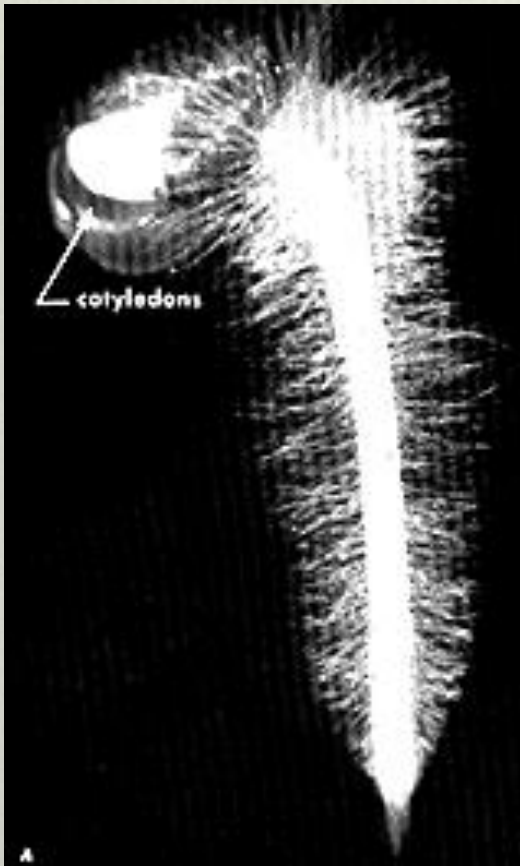
Root Hairs

Root Structure

root hairs: increase surface area

for greater absorption

H₂O and minerals



Secondary Root Growth

Root Structure

Secondary Growth = growth in diameter

Stem Function

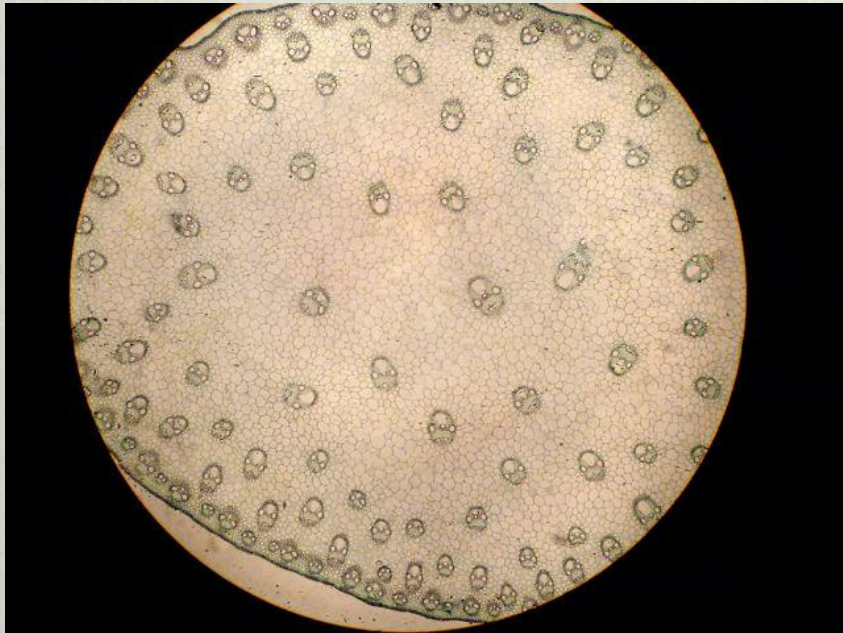
Stem Function

- make
- support ...
- display ... Leaves!
- conduct material to & from leaves

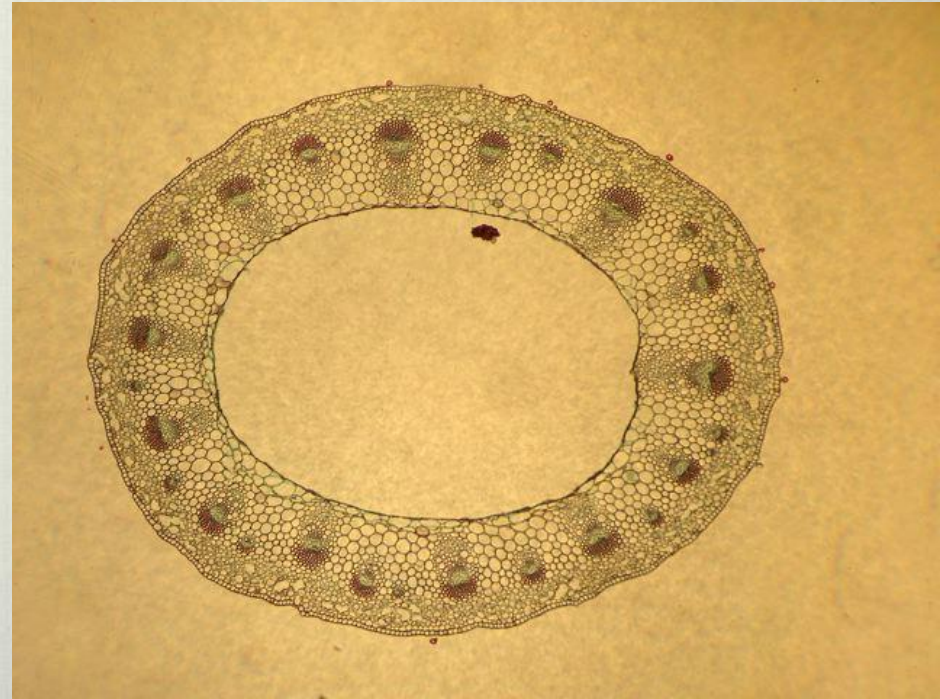
Stem Structure

Stem Structure

monocot stem



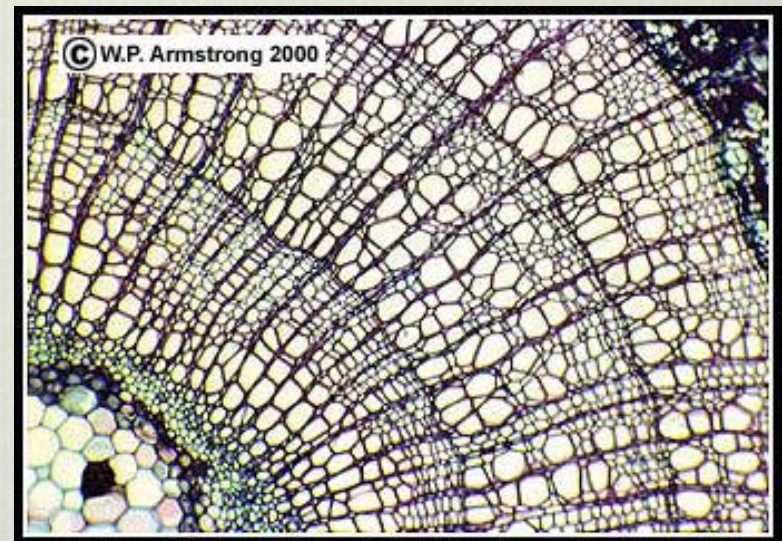
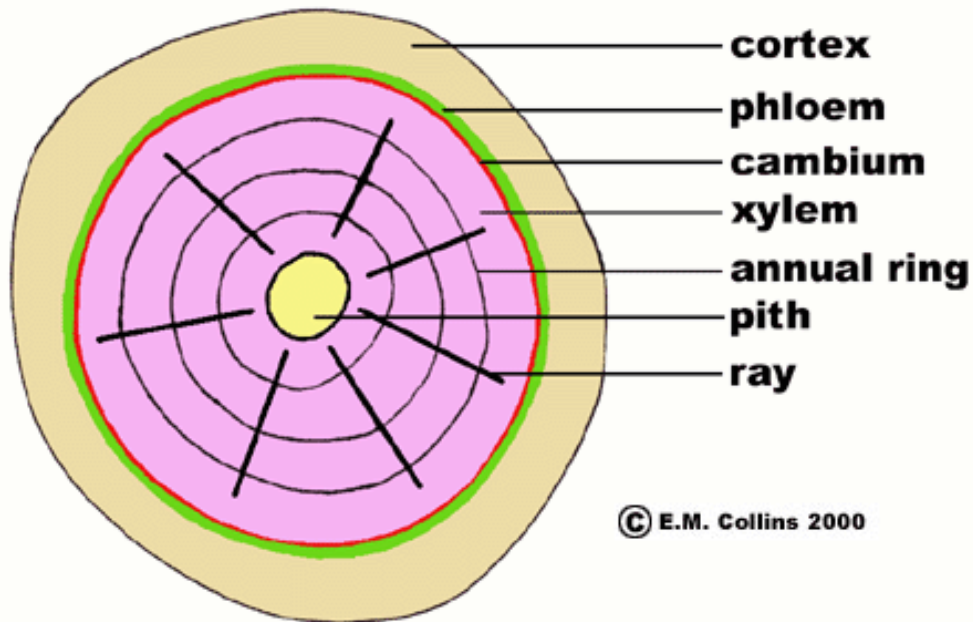
dicot stem



Stem Structure

Stem Structure

Annual rings are
spring & summer xylem



Hardwood and Softwood

Stem Structure

Heartwood: dead xylem

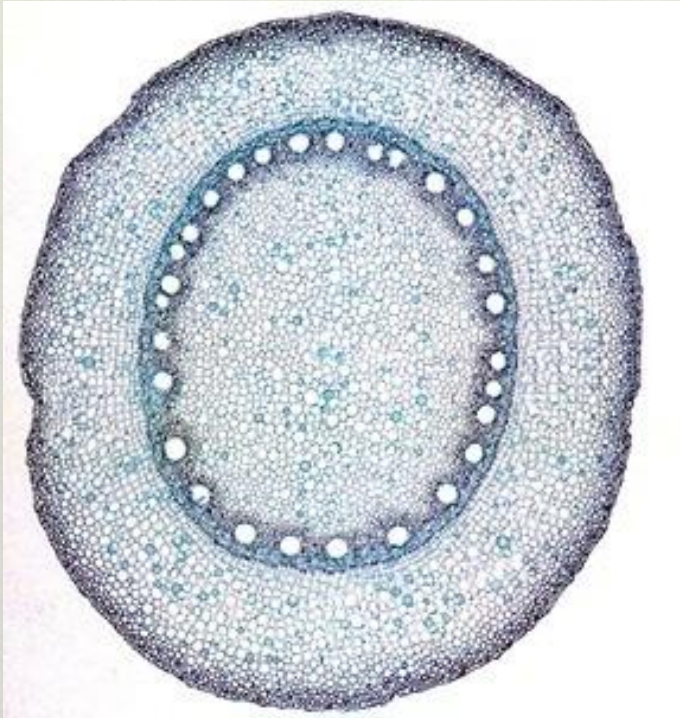
Sapwood: new xylem

Hardwood: from slower growing angiosperm

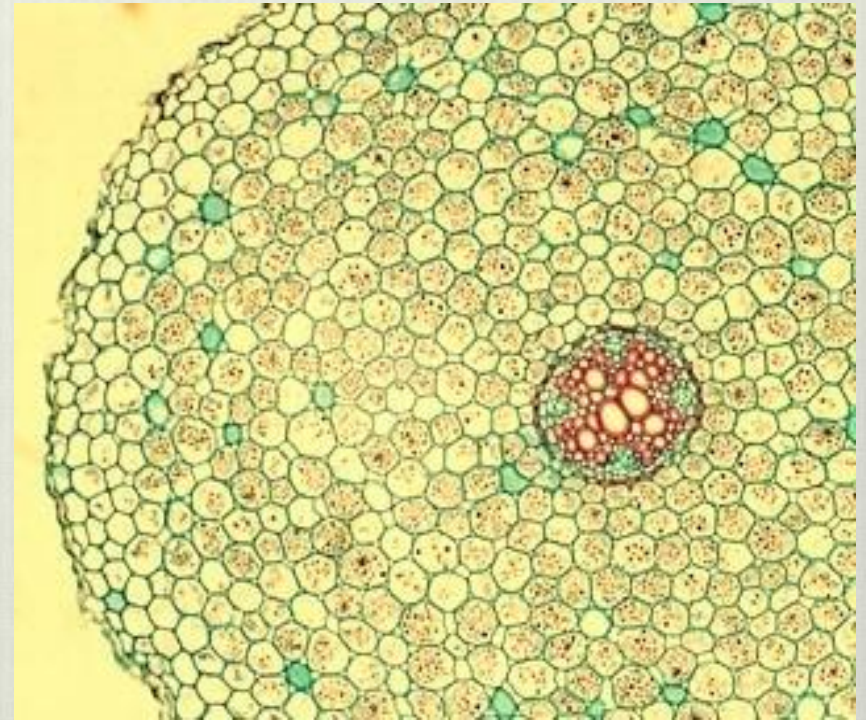
Softwood: from faster growing gymnosperm

Ch. 13 Plant Kingdom & Plant Structure

13B Plant Anatomy



monocot root



dicot root

Plants Physiology

- ❖ Water
- ❖ Soil
- ❖ Circulation
- ❖ Minerals
- ❖ hormones

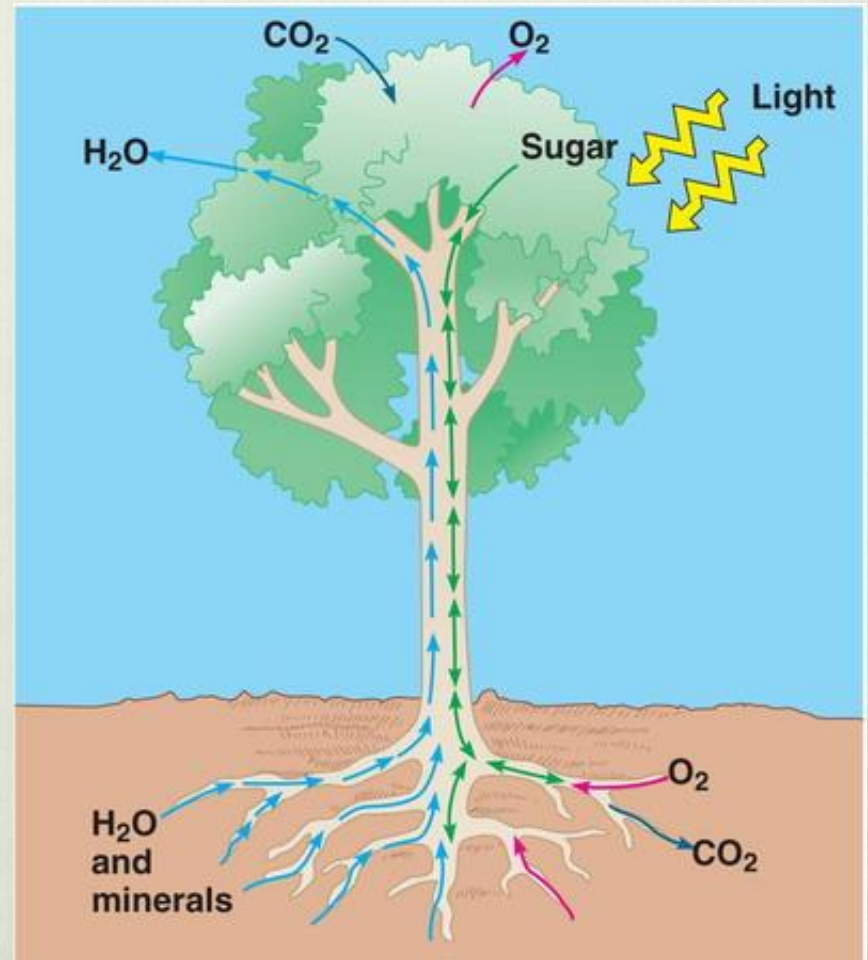
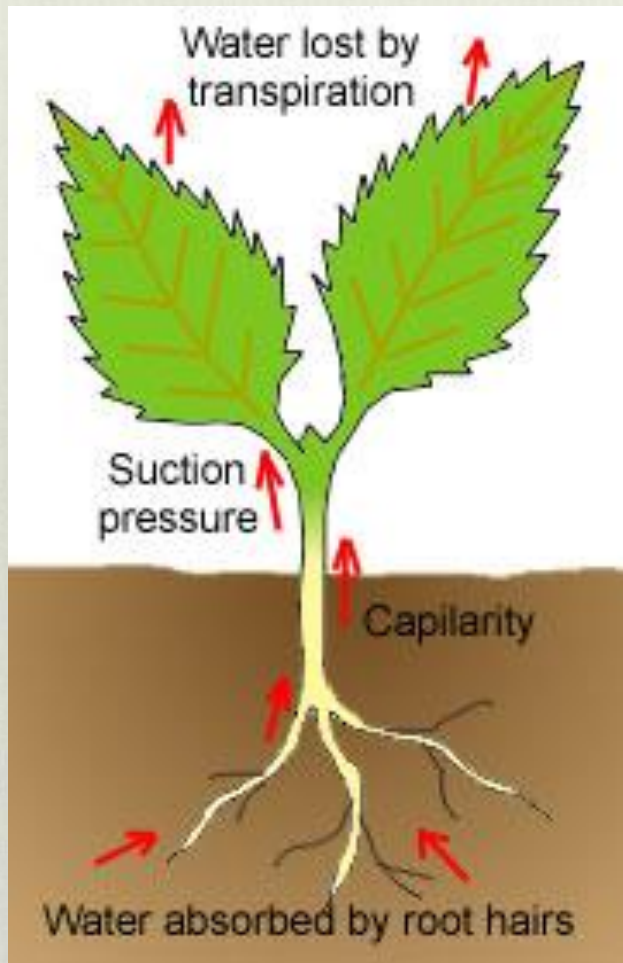
Plant Physiology

- ❖ The role of water for a plant
 - ❖ Photosynthesis – the Hydrogen is used in the light rxn
 - ❖ Turgor – structure of the plant, plants wilt without water.
 - ❖ Hydrolysis – remember this is “breaking apart with water”. This is the breaking of large organic molecules.
 - ❖ Circulation – water is the “life blood” of the plant.

Plant Circulation

- ❖ How does water defy gravity and move up the plant?
 - ❖ Root pressure
 - ❖ Capillarity
 - ❖ Transpiration-cohesion theory – pull of water (like a straw) from the evaporation of the stomata and water “stickiness”.

Transpiration



Plant Movement

- ❖ Nastic Movements of Plants
 - ❖ Changes in turgor pressure to control the movement of a plant.
 - ❖ Ex. venus flytrap, morning glory, clover, prayer plant.

Plant Movement



Plant Minerals

- ❖ Nitrogen
- ❖ Phosphorus
- ❖ Potassium
- ❖ These are the big three 10 -10 -10 fertilizer.
- ❖ Sulfur, Magnesium, Calcium, and Iron.
- ❖ P. 371
- ❖ Too much fertilizer will “burn” the plant. The salt concentration is higher in the soil than in the plant cells, so what happens to the water in the cell?

Plant Minerals

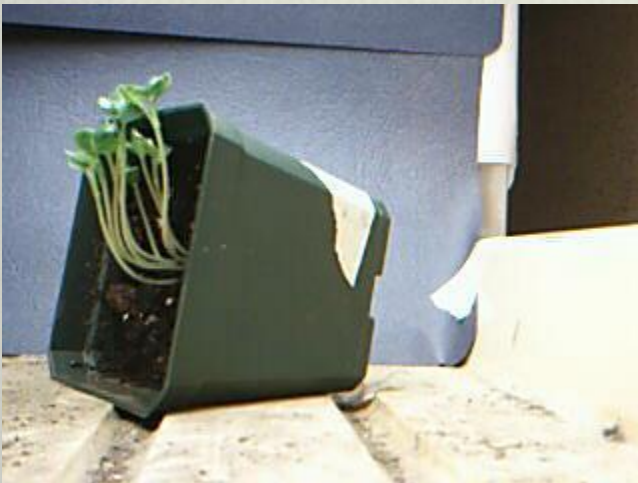


Plant Hormones

- ❖ A hormone is any chemical produced by the plant to cause a response by the plant.
- ❖ Auxins – many purposes
- ❖ Gibberellins – for growth
- ❖ Cytokinins – cell division
- ❖ Ethylene – ripen rapidly
- ❖ Absciscic acid – inhibit other hormones

Tropism

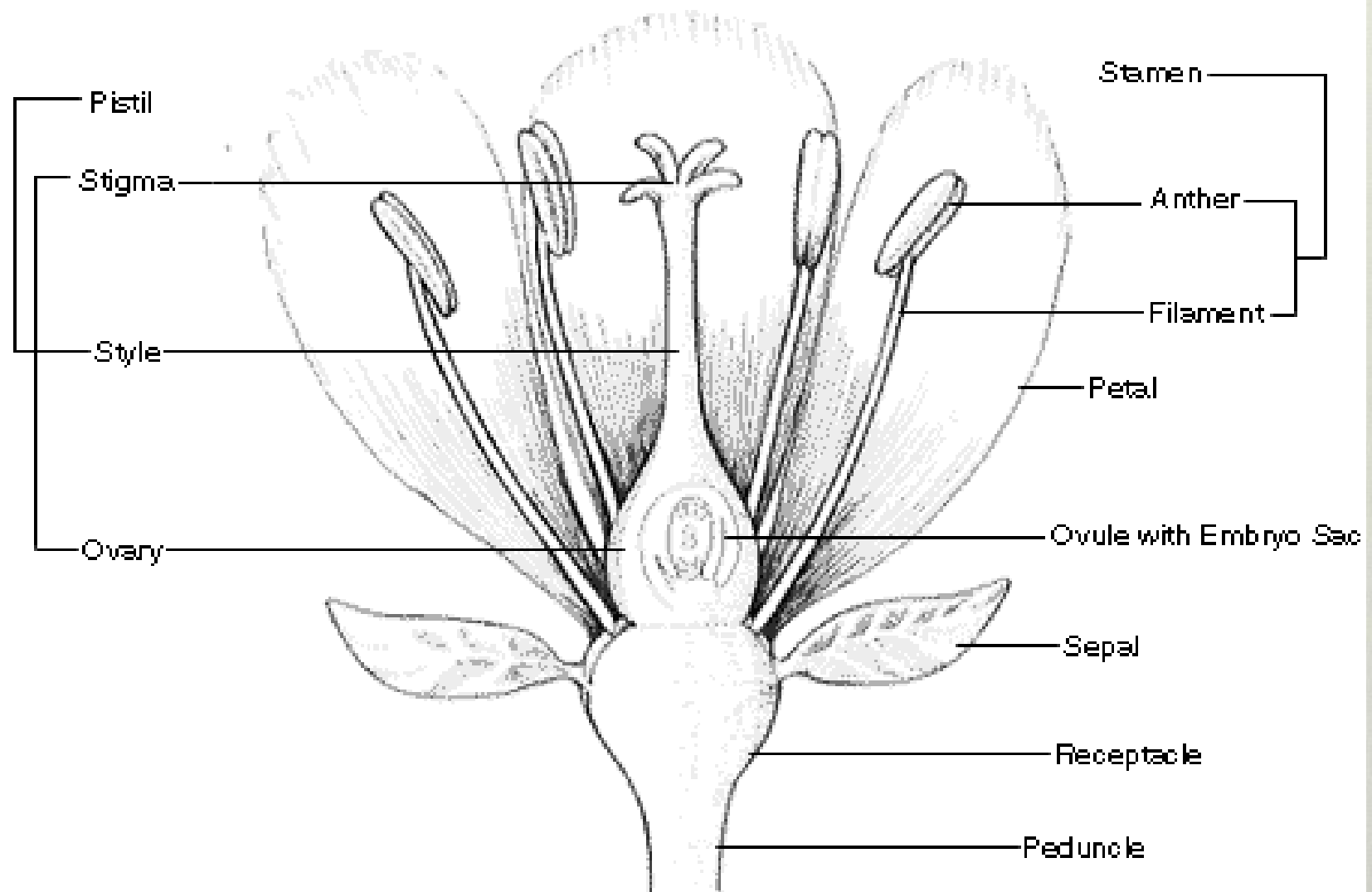
- ❖ Phototropism – movement in response to light
- ❖ Gravitropism – response to gravity.
- ❖ Thigmotropism – response to touch
- ❖ Chemotropism – response to chemicals



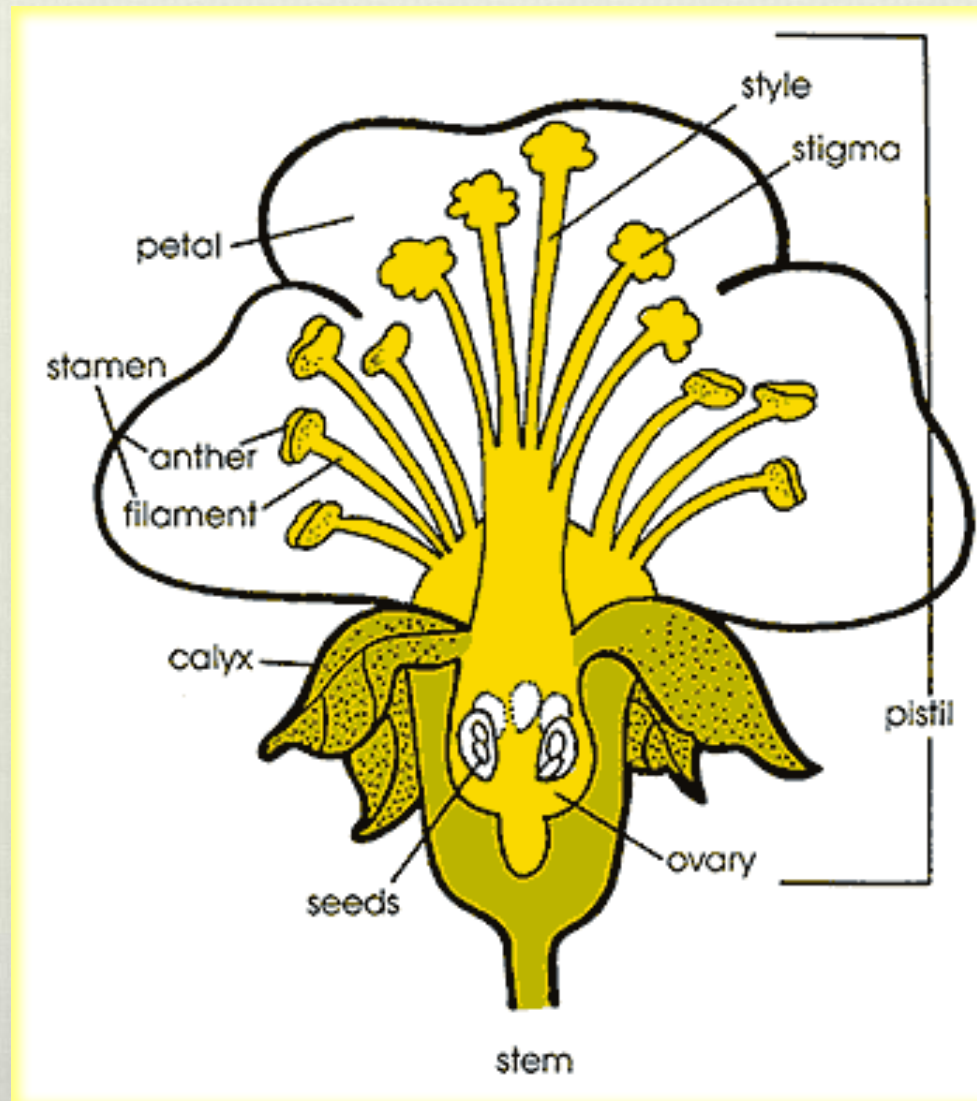
Photoperiodism

- ❖ The length of day affects the flowering of many plants.
- ❖ Examples of short day plants (less than 10 hours of sunlight) are poinsettias, asters, soybeans, corn, or strawberries. Flower in early spring, fall or winter.
- ❖ Long day plants are sunflowers, irises, sweet clover. Summer
- ❖ Neutral plant examples are marigolds, roses, beans carnations, and peas. These can flower anytime.

Flower parts



Flower Parts



Pollenators



How Pollen spreads

